

5 PEST MANAGEMENT

INTRODUCTION

This chapter describes how Integrated Pest Management practices contribute to protection of the environment. It contains introductory information on the relationship between pest management and the environment. It also contains information on environmental concerns, legislation and beneficial management practices related to:

- ◆ pest management
- ◆ pesticides

PEST MANAGEMENT AND THE ENVIRONMENT

Pests are a constant threat to the economical production of food crops and animals. They may also affect food safety and reduce natural biodiversity. Pesticides are chemicals designed to protect crops and animals from pests and can pose risks to the environment. Pesticides are regulated to minimize known and potential risks through prescribed storage, handling, application and disposal practices. The proper implementation of Integrated Pest Management (IPM) practices helps to protect the environment from potential adverse effects of pests and pesticides.

Integrated Pest Management (IPM)

Integrated Pest Management is a decision-making process for pest control. The process contributes to effective, economical and environmentally sound suppression of pests for crop and livestock production.

Noxious Weeds

Noxious weeds are typically non-native plants that have been introduced to British Columbia but without the insect predators and plant pathogens that normally keep them in check in their native habitats. For this reason and because of their aggressive growth, these alien plants can be highly destructive, competitive, and difficult to control. Noxious weeds are among the top causes for loss of natural diversity in the environment.

Pesticides

Pesticides are any kind of material used to kill, control, or manage pests. Fungicides, insecticides, miticides, herbicides, rodenticides and plant growth regulators are all types of pesticides.

Pests

Pests are organisms that cause undesirable effects and include fungi, bacteria, viruses, nematodes, insects, mites, weeds, slugs, rodents, birds and wildlife. They may occur naturally or be introduced from other areas.

Invasive Pests. Invasive pests not only pose a threat to crops and livestock, but also threaten native biodiversity by competing with local species for food and space. Many of the pests affecting cultivated and native

plants in BC have been inadvertently introduced into this province. In the absence of natural controls, they have become established and have extended their range as the environment and as availability of host plants permits. Examples of invasive pests include gypsy moth, purple loosestrife, knapweed, canola blackleg, blueberry scorch virus and European chafer.

PEST MANAGEMENT



PEST MANAGEMENT ENVIRONMENTAL CONCERNS

Primary environmental concerns related to controlling pests focus on pesticides. → see Pesticides, page 5-10

Primary environmental concerns related to pests are:

- ◆ lack of control of pests that results in loss of biodiversity and natural beneficial organisms through invasive diseases, insect, and weed infestation
- ◆ improper choice of pest management strategies that results in soil erosion, water or air pollution; or impacting non-target organisms

For information on these concerns:

- see Soil Quality Factors, page 8-1, and refer to Contaminants
- see Water Quality and Quantity Factors, page 9-1, and refer to Contaminants
- see Air Quality Factors, page 10-1, and refer to Contaminants
- see Impacts on Biodiversity and Habitat, page 11-3

PEST MANAGEMENT LEGISLATION

The following is a brief outline of the main legislation that applies to pest management.

- see page A-1 for a summary of these and other Acts and Regulations

Local Bylaws

Many local governments have specific bylaws or restrictions on noise scaring devices for bird control.



Integrated Pest Management Act

This Act and the *Integrated Pest Management Regulation* have numerous requirements regarding the use, containment, transport, storage, disposal and sale of pesticides.



Plant Protection Act

Regulations under this Act provide for the prevention of the spread of designated pests and diseases destructive to specific plants.

**Weed Control Act**

This Act requires all land occupiers to control designated noxious plants. The *Weed Control Regulation* designates noxious weeds, provincially and regionally.

**Wildlife Act**

This Act (as amended by the *Wildlife Amendment Act 2004*) regulates species at risk on Crown and private lands.

**Fisheries Act**

This Act has two sections of importance to pesticide management:

- ◆ Section 35: prohibits harmful alteration, disruption or destruction of fish habitat unless authorized (e.g., removing stream side vegetation)
- ◆ Section 38(4): requires reporting infractions of Section 35

**Plant Protection Act**

This Act protects plant life by preventing the importation, exportation and transportation of pests.

**Species at Risk Act**

This Act has sections that protect listed species, their residence and critical habitat. It applies to federal lands, internal waters (i.e., all watercourses), territorial sea of Canada, and the air space above them.

PEST BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable pest management related legislation, including the above, and where applicable, implement the following beneficial management practices to protect the environment.

Integrated Pest Management (IPM)

Integrated Pest Management is an approach that relies on the balanced use of sound practices to protect crops, animals, and the environment from the adverse impact of pests. Integrated Pest Management does not mean that chemical pesticides are never used nor does it require complete elimination of all pests. A properly designed program aims to create conditions that are optimal for crop production and less favourable for pest development.

Benefits of Integrated Pest Management as it applies to environmental protection include:

- ◆ use of production practices that reduce or prevent development of pest problems
- ◆ use of practices to determine both the need for and the correct timing of pesticide applications
- ◆ reduced reliance on pesticides by effective use of non-chemical biological, cultural, behavioural, and mechanical control practices either alone or in combination with pesticides
- ◆ reduced risk of pesticide resistance development that can lead to eventual increased pesticide use
- ◆ use of least-toxic, target-specific pesticides

Table 5.1 Steps to Develop an Integrated Pest Management (IPM) Plan

1. Plan & Manage Crop and Animal Production to Avoid Pest Problems

- select a site that is environmentally suited to the crop, or select a crop or crop variety suited to the growing site to minimize predisposition of the crop to pest attack or competition
- optimize crop and animal health to avoid predisposition towards pest infestation
- encourage the establishment of available biological control agents that can keep pests from becoming problems
- use recommended crop and manure management practices to prevent or reduce the risk of attracting and establishing pests

Example: Brussels sprout variety ‘Vancouver’ is used in the Fraser Valley because of its suitability to that climate and its disease tolerance to pathogens significant to the area.

2. Identify & Understand the Pest

Develop a management strategy using information on how the pest, crop and environment affect one another. Determine:

- how to correctly identify the pest and the damage it causes to a crop
- the pest’s life cycle and its preferred food and environment requirements – most pests go through at least one developmental stage where control measures and products are most effective
 - different products may target a different life cycle stage
 - timing the use of control actions to occur at the pests’ susceptible stage
- what conditions promote pest introduction, development and population increase
- how to identify any beneficial organisms that eat, compete with, or parasitize the pest

Example: Two fungal diseases of chrysanthemum must be properly identified because one (brown rust) causes minor damage and is not of regulatory significance and the other (white rust) is an invasive pest regulated by the Canadian Food Inspection Agency. Improper identification or a delay in action will result in greater infestation and significant losses.

3. Monitor Populations of Pests and Beneficial Organisms, Pest Damage & Environmental Conditions

Monitor the crop, flock or herd regularly to collect information on:

- the abundance and stage of development of pest populations
- the numbers of beneficial organisms present
- the crop stage and vigour
- the amount of crop damage
- temperature and moisture conditions - used in models to predict the occurrence of specific pest stages which can assist in decisions regarding the timing of pest management actions (few of such models are available at this time)

Example: Using an apple scab forecaster in an apple orchard is a model to determine when fungicides should be applied. The model uses leaf wetness and temperature data to predict the most likely period of infection.

4. Use Economic Thresholds (if available) or Experience in Making Pest Control Decisions

Ideally, pests are controlled immediately in advance of reaching a level that causes unacceptable economic damage. However, such threshold data do not exist for the majority of pests. Take the following considerations into account:

- use the information collected from monitoring to decide if and when control actions are necessary
 - the susceptibility of the crop to damage at various stages of growth
 - pesticide use restrictions such as pre-harvest interval, re-entry interval, buffer zone
- compare the pest control cost with the value of potential losses (quantity and/or quality) if the pest is not controlled
 - economic thresholds are specific for given crop/pest combinations and can vary depending on local crop values and control costs
- consult with local experts or use past experiences to make control decisions

Example: Leaf rollers are counted in raspberry buds in spring and insecticide is used only if more than 10% of buds are affected (i.e., more than 10 leaf rollers per 100 buds).

Table 5.1 (Continued)

5. Choose Appropriate Control Methods

Use a combination of biological, cultural, mechanical, behavioural and chemical controls as described below. Chemical control can be considered when other preventive control options fail to keep pest levels sufficiently low.

Biological Control: relies on natural beneficial enemy organisms such as predators and parasites to control pests

- predators eat the pest
- parasites and some predators live in or on the pest to weaken or kill it
 - parasites are often too small to be seen but are extremely important in controlling pests
- some microorganisms (i.e. bacteria, fungi, nematodes) reduce populations of plant pathogens or insect pests
 - healthy soils often have high populations of “good” microorganisms
 - commercially available beneficial microorganisms are slowly becoming more available
- monitoring and managing beneficial organisms is an important part of an Integrated Pest Management program

Example 1: The controlled introduction of two moth species, one feeds on roots and the other on leaves and one flea beetle species, has provided successful control of the noxious weed Tansy Ragwort in localized areas on Vancouver Island and the Fraser Valley.

Example 2: Livestock grazing can help prevent weed seed production and gradually weaken the roots, reducing weed establishment and proliferation.

Cultural Control: production practices that discourage the introduction, establishment or development of pest populations, such as

- selection of varieties resistant to pests
- planting of cover crops that compete with weeds and which shelter or feed beneficial insects
- rotating of crop varieties planted to reduce the level of pests
- pruning to remove diseased material, thin fruit or plants to create an environment less attractive to pests
- planting of certified material
- reducing the accumulation of plant residues and animal waste where pests can breed
- timing of cultivation or soil disturbance

Example: Removal of waste material from confined livestock and poultry operations at least once every 10 to 12 days during the fly breeding season helps with fly control.

Mechanical Control: involves the use of barriers or devices to exclude or control pests such as window screening, netting, rodent traps, seed cleaning to remove weed seeds, air curtains, fly paper, ground fabric, mulches

Example: Netting on blueberry farms provides non-toxic, non-lethal, and effective bird control.

Behavioural Control: takes advantage of specific attraction or repulsion responses of pests to certain odours, sounds, and colours in order to confusion or disorientation

Examples: Insect mating disruption using sex attractants (pheromones), odour-baited traps, yellow sticky traps, distress recordings, repellents, and black light electrocutors are all behavioural control examples.

Chemical Control: involves the use of pesticides to reduce pest levels - pesticides vary greatly in risk posed to the environment, mode of action, chemical structure, target specificity, and toxicity (refer to Crop Production Guides)

- use least-toxic or reduced-risk pesticides such as insect growth regulators and biological pesticides derived from plants, bacteria or fungi
- use pesticides according to label directions for most effectiveness and to pose the least risks to the environment
- alternate pesticides from different chemical classes or groups to prevent or delay the development of pesticide resistance
- spot spray where possible

Example: Herbicides in pasture and rangeland, along with primary weed management strategies such as grazing and correct fertilizer applications can lead to good weed control.











6. Evaluate the Effects & Efficacy of the Program

- keep good records such as: pest and weather monitoring, pesticide application (site or area treated, products and amounts used, crop stage, application dates, crop harvest dates, application methods, spray volume), crop yield and quality, and any other observations related to the condition or appearance of the crop or animals
- annually review this information to decide how to improve the Integrated Pest Management program

Integrated Pest Management (IPM) is promoted and explained in the commodity-specific Crop Production Guides, shown below. They form a part of the Environmental Farm Plan series of Beneficial Management Practices. This detailed information is recommended for use by producers of these crops. Table 5.1, previous two pages, outlines the basic steps in an Integrated Pest Management



For more detailed information on Integrated Pest Management for specific crops, refer to the following publications.

-  Berry Production Guide
-  Field Guide to Disorders of Fruit Trees
-  Field Guide to Harmful and Beneficial Insects and Mites of Tree Fruits
-  Floriculture Production Guide
-  IPM for Turfgrass Managers
-  Management Guide for Grapes
-  Nursery and Landscape Pest Management & Production Guide
-  Seven Steps to Managing Your Weeds: A Manual for Integrated Weed Management in British Columbia
-  Tree Fruit Production Guide
-  Vegetable Production Guide

Pathogens

Pathogens (disease-causing organisms) are easily spread and diseases impact the host (plant or animal). Prevention is the best management strategy, but early detection and treatment can also be effective. While many pathogens are crop-specific, some may affect a wide range of crops. Implement the following practices:

- ◆ use clean certified seed or plant sources, where available
- ◆ remove infected plants or affected plant parts to prevent further spread
- ◆ practice crop rotation to discourage the build up of specific pathogens
- ◆ select disease-resistant varieties, where available
- ◆ use qualified laboratories to confirm pathogen identification and then follow their recommendations

Soil Fumigation. This technique is used to control soil borne pests such as nematodes. Implement the following practices:

- ◆ follow label restrictions
- ◆ use certified pesticide applicators having proper equipment
- ◆ do not apply when the weather forecast is for heavy rain
- ◆ ensure that adequate moisture is in the soil prior to fumigation
- ◆ use plastic tarps to seal in the fumigant to reduce air pollution and to increase effectiveness of treatment
- ◆ ensure that adequate buffers are in place to prevent soil loss from fumigated fields left bare through winter → see Buffers, page 7-3

Insects and Mites

Insects and mites are easily spread and can impact the host (plant or animal). The life cycles for many insect pests are well known and most management strategies target a specific developmental stage. Implement the following practices:

- ◆ remove insects to prevent their spread to other hosts
- ◆ practice crop rotation to discourage the build up of pests
- ◆ select insect-resistant or tolerant varieties of crops, where available
- ◆ monitor population levels of both pests and beneficial organisms
- ◆ learn to identify all species and development stages of pests and beneficial organisms
- ◆ protect and encourage the establishment of beneficial organisms
- ◆ when possible and appropriate, release (introduce) beneficial organisms

Flies in Confined Livestock Facilities. An integrated fly management program involves a combination of appropriate animal waste management and fly prevention measures. Implement the following practices:

- ◆ begin a fly control program early in the year
- ◆ maintain low fly populations by using
 - biological fly control programs
 - electronic zappers
 - chemicals such as fly cake and/or insecticidal bait bands or boards

Implement the following practices to reduce the need for pesticides to control nuisance fly populations:

- ◆ reduce or periodically remove fly breeding materials such as manure, bedding, and spoiled feed
- ◆ ensure that potential breeding materials are dried quickly and remain dry
- ◆ store manure in enclosed structures if it cannot be dried easily or if it cannot be spread every 10-12 days
- ◆ dispose of dead animals using approved disposal methods → see Livestock Mortality Disposal, page 3-30

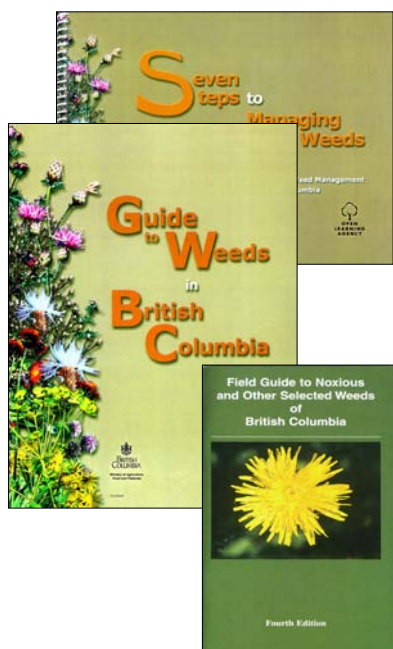
In some situations, regular spraying with insecticides may be necessary for effective fly control. Seek advice from a qualified pest control specialist before embarking on any spraying programs. Ensure that only approved chemicals are used. Spraying should never be considered a substitute for proper waste management.

 **Management of Flies in Layer Barns**

Weeds

Weeds reduce crop growth and affect the ability of crops to effectively use nutrients. Although some weeds can use a significant amount of soil moisture and nutrients, as they are not harvested the nutrients remain in the field and will be released when the weed material breaks down. To reduce the impact of weeds, implement the following practices:

- ◆ always use clean certified seed
- ◆ control problem weeds before they go to seed
- ◆ practice crop rotation to discourage build up of specific weeds
- ◆ learn to identify weeds, particularly at the seedling stage
- ◆ apply appropriate controls at the recommended stage of crop and weed development



- ◆ control persistent perennial weeds prior to planting crops
 - ◆ use plastic and organic mulches to control or suppress weeds, when appropriate
 - ◆ prevent the movement of weeds to new locations via movement of livestock or equipment
 - discourage visits to farm if the potential for weed movement exists
- ➔ see Invasive Pests, next page

- 📖 Integrated Weed Management
- 📖 Seven Steps to Managing Your Weeds: A Manual for Integrated Weed Management in British Columbia
- 📖 Rangeland Handbook for BC
- 📖 A Guide to Weeds in British Columbia

Noxious Weeds. Noxious weeds should be prevented from becoming established on a farm and, if present, prevented from spreading to neighbouring properties. They are listed in the *Weed Control Regulation*.

- 📖 Invasive Plant Alert: Prevent the Escape of Aggressive Plants
- 📖 Field Guide to Noxious and Other Selected Weeds of British Columbia
- 🌐 www.qp.gov.bc.ca/ststreg/reg/W/66_85.htm

Wildlife

Some wildlife, such as rodents and some birds, are managed as pests. Other wildlife, such as deer, elk, or beaver, are managed as problem wildlife. For problem wildlife information, ➔ see Biodiversity Conflicts, page 11-16

Rodents

To effectively ward off rodent infestations, implement the following practices:

- ◆ control food and water supplies by
 - avoiding spillage of feed both inside and outside barns
 - keeping all feed in covered containers
 - eliminating water sources like leaky taps, sweaty pipes and open drains
- ◆ rodent-proof buildings and eliminate nesting sites by
 - keeping buildings in good repair
 - keeping areas next to buildings free of weeds, long grass, and debris
 - screening ventilation ports and other openings
- ◆ maintain good general sanitation and cleanliness throughout the farmstead

When rats and mice are established, they can be controlled by poisoning with rodenticides, fumigating, trapping or any combination of such practices. Always place rodenticides in covered bait stations. If placed in and around manure piles, collect before the manure is removed for land spreading. Rodenticides spread on land with waste products pose a serious threat to pets, birds, farm animals, and wildlife.

- 📖 Control of Rats and Mice on Poultry Farms

Birds


Starlings, robins, crows, magpies and other bird species are a nuisance to livestock producers, and often implicated in the spread of diseases. Controls measures are usually less effective once birds have established feeding patterns. Implement the following practices:


- ◆ bird-proof structures that store or contain grain
- ◆ clean up spilled grain immediately
- ◆ drain or fill water pools and puddles as starlings are attracted to water

- ◆ keep water in livestock waterers at levels low enough to prevent birds from drinking when perched on the waterer edge

To manage bird problems use techniques or equipment such as bird distress calls, noisemakers, netting, population control, and starling traps. **Check local municipality bylaws before using any methods.**

 Bird Control for Agricultural Lands in British Columbia


 Starlings and Livestock Farms

 Berry Production Guide

Manage audible bird scaring devices according to Normal Farm Practices as set out in decisions issued by the Farm Practices Board for similar farms in similar circumstances.

 www.agf.gov.bc.ca/ministry/fpb.htm

Otherwise, follow MAFF's Wildlife Damage Control guidelines.

 Wildlife Damage Control - Interior BC

 Wildlife Damage Control - South Coastal BC

Invasive Pests

It is important that any unusual or unfamiliar diseases, insects, or weed species be reported to MAFF or the Canadian Food Inspection Agency so that the species can be identified and so that appropriate eradication action can be taken. Check the MAFF website for additional information on new and threatening invasive species. → see Weeds, page 5-7, and → see Chapter 11, Biodiversity

 www.agf.gov.bc.ca/cropprot/nonnativepests.htm

To reduce the possibility of introducing invasive pests to a farm, check with the Canadian Food Inspection Agency for permit requirements and other restrictions before importing plant material from outside B.C.

 www.inspection.gc.ca

PESTICIDES



PESTICIDE ENVIRONMENTAL CONCERNS

Primary environmental concerns related to pesticides are:

- ◆ pesticides inappropriately applied, spray or vapour drift, spills, backflow and improper disposal of chemicals or containers that results in soil, water or air pollution; or in damage to non-target organisms
- ◆ birds and wildlife coming into contact with pesticides or crops applied with pesticides that results in damage to birds and wildlife; or bio-accumulation

For detailed information on these concerns:

- ➔ see Soil Quality Factors, page 8-1, and refer to Contaminants
- ➔ see Water Quality and Quantity Factors, page 9-1, and refer to Contaminants
- ➔ see Air Quality factors, page 10-1, and refer to Contaminants
- ➔ see Impacts on Biodiversity and Habitat, page 11-3, and refer to Impacts to Biodiversity and Habitat

PESTICIDE LEGISLATION

The following is a brief outline of the main legislation that applies to pesticides.

- ➔ see page A-1 for a summary of these and other Acts and Regulations

Local Bylaws

The National Farm Building Code 1995 outlines standards for pesticide storage and **is enforced only where proclaimed by local governments.**

- ◆ Section 4.1.4: requires storage facilities for pesticides to be:
 - vented to the outdoors, accessible from outdoors only, secured against unauthorized entry
 - has an impervious floor that is curbed to contain spills,
 - identified with a sign at entrance stating “Danger – Chemical Storage – Authorized Person Only” or words to that effect
 - separated from all food, feed and water supplies
 - insulated and heated cabinet for chemicals requiring frost protection
 - separate oxidizing and flammable chemicals
 -



Drinking Water Protection Act

This Act prohibits introducing, causing or allowing anything that will result or is likely to result in a drinking water health hazard to a domestic water system.



Health Act

This Act has conditions under the *Sanitary Regulations*:

- ◆ Section 9: prohibits accumulation or discharge of wastes that endanger the public health

- ◆ Section 42: requires a separation distance from wells to be at least 30.5 m from any probable source of contamination (probable source of contamination could include pesticides)
- ◆ Section 43: prohibits contamination of any domestic water supply
- ◆ Section 70.1: requires the reporting of any potentially toxic chemical escape to the nearest Medical Health Officer (toxic chemical escape could include pesticide spills)




Integrated Pest Management Act

This Act and the *Integrated Pest Management Regulation* have numerous requirements regarding the use, containment, transport, storage, disposal and sale of pesticides.

- ◆ Section 2: describes the classes of pesticides in relation to licensing and use
- ◆ Section 5 describes the types of pesticide use requiring a licence
- ◆ Section 18(2): describes the pesticides and pesticide uses requiring a permit, such as uses near water and aerial application to agricultural land
- ◆ Section 33: describes that containment, use, storage, transport and use of pesticides must minimize hazards to human health and the environment
- ◆ Section 65; describes container and labelling standards in relation to handling and storage of pesticides
- ◆ Section 66: describes pesticide storage such as separation from food intended for human or animal consumption and the near for the storage to be locked, ventilated, and labelled with a warning

Restricted pesticides (identified on the label) can only be applied by a person who has passed the pesticide applicator's exam and who has a valid Pesticide Applicator Certificate issued by MWLAP. Study material can be purchased by phoning 1-800-282-7955.

 **Pesticide Applicator Course for Agricultural Producers**



Environmental Management Act

This Act has two regulations dealing with pesticides.

The *Spill Reporting Regulation* requires spills of a polluting substance be reported immediately to the Provincial Emergency Program (PEP) at 1-800-663-3456 (24 hour service). Report spills of pesticides (pesticide, pesticide mixture or waste) greater than 5 kg or 5 litres.

The *Hazardous Waste Regulation* specifies empty pesticide containers will be considered hazardous waste unless rinsed and disposed of according to Table 5.2, next page. Equipment wash water is also dealt with in Table 5.2.



Wildlife Act

This Act (as amended by the *Wildlife Amendment Act 2004*) regulates species at risk on Crown and private lands.



Fisheries Act

This Act has three sections of importance to pesticide management:

- ◆ Section 35: prohibits harmful alteration, disruption or destruction of fish habitat unless authorized (e.g., removing stream side vegetation)
- ◆ Section 36(3): prohibits the deposit of deleterious substances into watercourses (deleterious substances could include pesticides)
- ◆ Section 38(4): requires reporting infractions of Section 35 or 36



Migratory Birds Convention Act

This Act prohibits the deposit of any substance harmful to migratory birds to any area frequented by migratory birds



Pest Control Products Act

The Act requires all pesticides used in Canada to be registered and have a Pest Control Products number on the label. Pesticides can only be used according to label directions (directions include environmental protection requirements).



Species at Risk Act

This Act has sections that protect listed species, their residence and critical habitat. It applies to federal lands, internal waters (i.e., all watercourses), territorial sea of Canada, and the air space above them.



Transportation of Dangerous Goods Act

This Act regulates the handling and transportation of “poisonous substances” which includes pesticides. Farmers transporting more than 1,500 kg of pesticides in a licensed farm vehicle more than 100 km must comply with special requirements. Farmers moving a sprayer containing more than 6,000 litres of spray mixture for more than 100 km on a public road must comply with special requirements.

Table 5.2 Hazardous Waste Regulation for Empty Pesticide Containers

Rinsing Method for Empty Pesticide Containers★	
Type of Container	Rinsing Method
Rigid plastic or metal (non-pressurized)	Pressure rinse ¹ for 30 seconds or single rinse 3 times
Rigid plastic or metal (pressurized)	No rinsing required
Glass bottle	Rinse ² three times
Paper or plastic bag	Rinse
Containers labeled “Domestic”	No rinsing required
Any container type not listed above	As approved by MWLAP
Disposal Method for Empty Pesticide Containers★	
A waste pesticide container emptied and rinsed in the above manner shall be recycled or may be disposed of: (a) in an approved landfill, or; (b) by burying it, but only if; (i) the burial location is owned or leased by the person owning the container; (ii) the burial location is on flat ground, not in a swale at least 200 m from surface water or a well; (iii) the ground does not consist of gravel, sand or other similarly porous material, and; (iv) the owner covers it with at least 0.5 m of soil immediately after burial.	
Disposal Method for Container and Equipment Wash Water★	
Waste produced by cleaning pesticide application equipment or by rinsing waste product containers under this section shall, if practicable, be used in mixing a product solution but, if not practicable, it may be applied to land if the area to which it is applied (a) is on land to which the product contained in the waste has been applied for pest control, (b) is flat ground, not in a swale, and at least 200 m from surface water or any well, and (c) does not consist of gravel, sand or other similarly porous material.	
★ Reg. Section 42 - these methods must be used for the containers not to be considered a hazardous waste. ¹ pressurized spraying of an appropriate solvent into an empty container for at least 30 seconds ² introduce an appropriate solvent into an empty container in an amount not less than 20% of its volume, to close and shake the container so that the solvent makes contact with all interior surfaces, and to open and empty the container	

PESTICIDE BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable pesticide related legislation, including the above, and where applicable, implement the following beneficial management practices to protect the environment.

Since pesticides are designed to harm target organisms, take proper safety precautions to protect non-target organisms and the environment. If pesticides reach water a high impact can occur.

Pesticide Applicators Certificate

Pesticides that require a Pesticide Applicator Certificate before purchasing or use are listed in the various Crop Production Guides. → see page 5-6

Pesticide Risks

Pesticide Movement. A pesticide is any material used to kill, control or manage pests, including products to manage the growth of plants. The primary concern related to pesticides is any unwanted movement to sensitive environmental areas such as watercourses, ground water, fish or wildlife habitat. Pesticides can move off-target by:

- ◆ drift – the movement of spray droplets or vapour in the air
- ◆ runoff – the movement in the water or bound to eroding soil
- ◆ leaching – the movement in water through the soil
- ◆ direct transport – the movement of soil, vegetation and other materials that contain pesticide residues

Movement of pesticides depends on pesticide characteristics, site characteristics, and pesticide application practices.

Pesticide Characteristics. Once released into the environment, pesticides dissipate at varying rates. Dissipation characteristics influence a pesticides' potential to harm the environment. Such characteristics include:

- ◆ degradation – the ability to break down in the environment
 - pesticides are broken down by microbes, chemical reactions and sunlight
 - the faster a pesticide degrades in the soil, the less likely it is to be carried to aquatic systems and ground water
- ◆ volatility – ability to turn into fumes
- ◆ solubility in water – ability to dissolve in water
 - soluble pesticides can leach through soil to ground water
- ◆ adsorption – the ability to bind onto soil particles
 - pesticides that bind to soil particles are less likely to contaminate water
- ◆ absorption – ability to move into organisms or materials
- ◆ bio-accumulation – ability to accumulate in tissues
- ◆ toxicity – the degree to which a substance is harmful or poisonous

When selecting pesticides, choose one with the shortest degradation period, lowest volatility, lowest solubility, highest capacity to bind onto soil, and lowest toxicity.

Site Characteristics. Site conditions affecting pesticide movement include:

- ◆ the infiltration and permeability of soil → see Contaminant Movement in Soil, page 8-14
- ◆ the binding capacity of soil to hold pesticides → see Contaminant Movement in Soil, page 8-14
- ◆ the closer the water table is to the surface, the greater the contamination risk
- ◆ the closer proximity to surface water bodies, the greater the contamination risk
- ◆ the steeper the slope is the greater is the risk of runoff (slope direction determines runoff path)

If a site is likely to pose a high risk of pesticide movement, select crops that require little or no pesticide application.

Pesticide Application Practices. Application characteristics affecting the movement of pesticides include:

- ◆ application method – direct-applied pesticides (wipe-on) have a lower risk than sprayer-applied
- ◆ droplet size – coarse droplets are less prone to drift than fine droplets
- ◆ application rate – lower rates decrease the risk of runoff and leaching

When selecting pesticide application equipment, choose methods that wipe-on chemical or produce coarse droplets, and have low application rates.

 [Pesticide Applicator Course for Agricultural Producers](#)

Pesticide Transport

When transporting pesticides, implement the following practices:


- ◆ transport only pesticide containers that are undamaged, properly labelled and securely closed
- ◆ secure pesticide containers in transport vehicles
- ◆ transport in a separate compartment from people, animals, food or clothing
- ◆ place pesticides on non-absorbent materials such as metal or plastic (wood is not considered a preferred material to wash spillage from)
- ◆ carry a pesticide spill cleanup kit

Pesticide Storage



When storing pesticides, implement the following practices:


- ◆ store following label directions
- ◆ use a locked, dry, vented to outside building posted with a “Warning – Chemical Storage – Authorised Person Only” warning sign on the door
- ◆ locate the building away from yard drains, ditches, wells, and watercourses
 - at least 30.5 m from any well (*Health Act*)
 - 15 m or more from watercourses (suggested)
 - 30 m or more from a water intake used for domestic purposes (suggested)
- ◆ construct the storage with curbs of concrete or other impervious material that will contain spills and allow for easy cleanup
- ◆ site or protect the storage from collision by vehicular traffic
- ◆ store pesticides in their original containers and close containers tightly
- ◆ if the original container is damaged, place pesticide in a suitable container

If the original label is illegible or missing, obtain a replacement label from the supplier or website  <http://eddenet.pmra-arla.gc.ca/4.0/4.0.asp> and

label container with the common name, trade name, quantity in container and PCP registration number

- ◆ do not store food, feed, fertilizer, seed, livestock or livestock medication with pesticides
- ◆ store herbicides separate from other pesticides to prevent cross-contamination
- ◆ locate a pesticide spill cleanup kit nearby
- ◆ store pesticide-treated seed in areas where animals, including wildlife will not come in contact with the seed
- ◆ keep an updated list of stored pesticides in case of fire or spill emergencies
- ◆ keep a list of emergency phone numbers in a convenient location know by all farm workers

Refer to Figure 5.1, below, for an example of a pesticide storage shed.

 On Farm Pesticide Storage and Handling Facilities

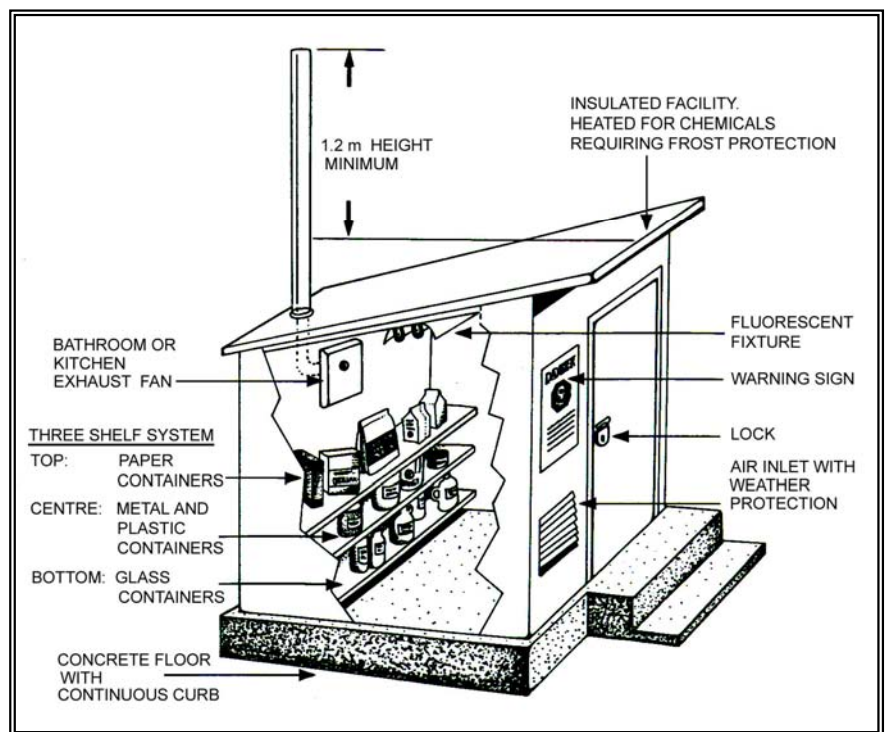


Figure 5.1 Pesticide Storage Shed

Pesticide Use Use Integrated Pest Management (IPM) principles to determine if and when pesticides may be needed. Only use pesticides that are registered for a particular pest and crop. Follow the specified uses on the label.

 www.eddenet.pmra-arla.gc.ca/4.0/4.0.asp has label information

Pre-Application. Before mixing pesticides, implement the following practices:

- ◆ ensure that the correct pesticide is selected for a given pest





- ◆ read the entire label carefully, including any attached booklets, and follow safety precautions and instructions. Sometimes environmental protection practices are scattered throughout the label
- ◆ know the size of the land area to be treated and know exactly how much pesticide is required for that area to avoid excess chemical disposal
- ◆ if spraying near an environmentally sensitive area, ensure that the pesticide can be used safely
 - determine the size and type of buffer needed to protect the sensitive area
 - → see Buffers, page 7-3
- ◆ ensure that the application equipment is in good working order
- ◆ ensure that equipment is calibrated
- ◆ be prepared to handle a spill

Equipment Calibration. Before mixing pesticides, ensure the equipment will apply the correct amount uniformly by completing a thorough calibration. Implement the following four-step equipment calibration practice:

- ◆ Step 1: set-up of the equipment (usually the most time-consuming step, but one that must be done to ensure uniform and properly targeted application)
 - ensure there are no leaks, spray boom is properly arranged for the target, and the swath width and driving pattern is determined
 - select nozzles, spray pressure and spray volume
 - measuring output of individual nozzles for uniformity and wear
- ◆ Step 2: measure the delivery rate of the applicator
- ◆ Step 3: adjust the delivery rate, if required, after comparing the measured delivery rate to the rate recommended on the pesticide label or from the Production Guide
- ◆ Step 4: calculate the amount of pesticide to add to the sprayer tank to provide the correct pesticide application rate (with the measured sprayer delivery rate from step 3)

Calibration should be done:

- ◆ before new or altered equipment is used
- ◆ when making changes that affect the delivery rate
- ◆ at regular intervals to see if wear is affecting output
- ◆ at least once a year

-  Pesticide Applicator Course for Agricultural Producers
-  various Crop Production Guides, (as listed on page 96)
-  Suggestions For Field Sprayer Operation And Maintenance
-  Calibration Worksheet - Boom Sprayer

Sprayer Filling and Mixing. To protect the environment at filling and mixing locations, implement the following practices:

- ◆ install an approved back-flow prevention device on the waterline or ensure that an air gap of at least 30 cm (suggested) between the end of the water supply line and the spray tank exists
- ◆ locate sprayer filling sites
 - at least 30.5 m from any well (*Health Act*)
 - 15 m or more from watercourses (suggested)

- at a lower elevation than any wells – if not at a lower elevation, have a berm around the well to divert runoff
- with buffer areas between it and all watercourses → see Buffers, page 7-3
- ◆ mix only the required pesticide needed for a single day
- ◆ have spill cleanup equipment such as absorptive materials and shovels readily available
- ◆ after emptying any pesticide container and prior to spraying its contents, rinse the container and pour the rinse water into the sprayer (rinse according to Table 5.2, page 5-12)

Application and Equipment Washing. While applying pesticides, implement the following practices:

- ◆ hold a valid Pesticide Applicator Certificate, if required by law
- ◆ use the application rate specified on the label
- ◆ maintain an untreated buffer between treated areas and sensitive areas
 - follow pesticide label setbacks from non-target aquatic and terrestrial areas, and from wells → see Buffers, page 7-3
- ◆ only apply pesticides by aircraft or chemigation if specified on the label
- ◆ apply pesticides in suitable weather conditions
 - do not spray in strong winds
 - do not apply if heavy rain is expected
- ◆ protect bees and other beneficial insects by applying pesticides
 - when flowers are not present
 - during early morning or late evening hours when insects are not active
 - away from insect drinking water sources
 - that are least toxic to insects
- ◆ shut off spray nozzles when they are over non-targeted areas (e.g., while turning on headlands)
- ◆ incorporate granular insecticides into soil to protect birds and wildlife
- ◆ clean sprayers as far as conveniently possible from watercourses, ditches, or wells to prevent pesticide movement from runoff into watercourses, or via leaching to ground water
 - cleaning sites must be at least 30.5 m from any well (*Health Act*)
 - 15 m or more from watercourses (suggested)
 - dispose of wash water by using as a pesticide or by following Table 5.2, page 5-12

Record Keeping. Knowing when, where and how pesticides were applied is a critical part of an IPM program, implement the following practices:

- ◆ maintain a record of all pesticide applications including the site (filed size and location), date, target pest, pesticide and amount used, crop stage, harvest date, application method, spray volume, weather observations, and precautions followed (e.g., Buffer zones). Often there are examples in Crop Production Guides → see, page 5-6 for list of Guides

Leaching Control. Pesticides that have a tendency to leach into ground water may have special restrictions on the label. Read and follow these instructions. Be aware of the depth of the ground water and characteristics of the site and pesticides applied.

Runoff Control. Runoff from areas treated with pesticides can pollute streams, ponds, lakes and wells. To reduce pesticide runoff, implement the following practices:

- ◆ to prevent the application of pesticides immediately prior to a heavy rain, check the weather forecast (rain can wash pesticides off treated surfaces and can cause runoff or erosion to occur from treated areas)
- ◆ use minimum tillage techniques to reduce soil erosion and runoff of pesticides bound to the soil
- ◆ leave a buffer of vegetation and plant material around ditches and natural water bodies to filter pesticide-contaminated runoff
- ◆ collect contaminated runoff, where feasible → see Runoff, page 9-39

Drift Control. Drift refers to the movement of pesticide droplets, dust or vapours, by wind or air currents, away from target areas.

The degree of drift is strongly related to droplet size. The smaller the droplet, the farther wind carries them from the target area. Fine droplets can be carried several kilometres. In addition, larger distances between the sprayer nozzle and the target will result in more drift.


Vapour drift from volatile chemicals can continue long after the spraying operation is completed. Small amounts of highly volatile pesticides can impact susceptible plants and watercourses near treated areas. This can occur even under stable air conditions because vapours tend to flow along the ground without dispersal.

To minimize spray drift, implement the following practices when practical:

- ◆ replace or clean faulty nozzles to reduce fogging
- ◆ use nozzles such as low-pressure, flat-fans, flooding, or raindrop nozzles to produce drops more resistant to drift
- ◆ use shrouded, air-assist or tunnel sprayers
- ◆ only use special, low-volume sprayers where suitable
 - such sprayers typically produce small droplets more subject to drift
- ◆ apply pesticides at low spraying pressures to reduce the number of fine spray droplets
- ◆ keep boom height as low as possible while maintaining uniform coverage
- ◆ do not spray in strong or gusty wind conditions or during dead calm
 - early morning and evening are often the best times but avoid temperature inversions

Use plastic tarps when fumigating soils to contain fumigant. Tarps not only reduce air pollution but increase the effectiveness of treatment. Tarp removal or cultivation of fields too soon after fumigation can result in the release of unwanted pesticide into the air. Plastic used in fumigation should go to a landfill.

Pesticide Application to Livestock. Several species of insects and mites attack cattle. Pesticides are available in various formulations to protect livestock from injury and disease associated with pest attack.

 Control of Insects and Related Pests of Livestock and Poultry in BC

To avoid contamination of soil and water, implement the following practices:

- ◆ use pour-on or spot treatments in place of whole-body sprays
- ◆ place self-activated and forced-use pesticide backrubbers at least 30.5 m from wells (*Health Act*) and 15 m from watercourses (suggested)

- ◆ ensure that backrubbers are not leaking and are adjusted correctly for dispensing appropriate concentrations of insecticide
- ◆ ensure that used insecticidal ear tags are collected and properly disposed

Pesticide and Pesticide Container Disposal

Disposal of pesticides is complicated and expensive. The best precaution to avoid such disposal is through good planning. Plan pesticide purchases to minimize the amount of pesticides stored and the accumulation of unwanted pesticides.

Excess Mixed Pesticide. Implement the following practices:

- ◆ reduce the volume of waste by mixing only the amount of pesticide required for a specific application
- ◆ do not store excess mixture in spraying equipment extended periods of time
 - pesticides damage sprayer components or undergo chemical degradation over time
- ◆ use excess spray mixtures on another crop or at another site if label specifications allow
 - do not exceed label application rates by re-spraying treated areas
- ◆ do not dump unused mixed pesticide on land or allow to drain into sewers or other piping systems

Excess Concentrated Pesticide. Implement the following practices:

- ◆ purchase no more than one year's supply of pesticide at a time
- ◆ return unopened pesticide containers to the manufacturer or dealer
- ◆ do not dump unused or unwanted pesticide concentrate on land or allow to drain into sewers or other piping systems
 - contact a hazardous waste disposal company or MWLAP for information on disposal of leftover pesticides

Disposal of Empty Pesticide Containers. After emptying pesticide containers it is a legislative requirement that all pesticide containers are properly rinsed and disposed of as outlined in Table 5.2, page 5-12. Implement the following practices:

- ◆ crush or puncture the container so that it cannot be reused
- ◆ dispose containers at pesticide container collection sites, or safely store for a short time until disposal is more convenient
- ◆ do not burn paper or plastic pesticide bags to prevent the release of toxic fumes

Some pesticide dealers in BC now accept properly rinsed metal and plastic containers for recycling. This is the preferred disposal method for containers.

Pesticide Storage Fires

Pesticide fires are extremely dangerous because they release highly toxic fumes. Implement the following practices:

- ◆ keep an up-to-date list of stored pesticides in an easily accessible location separate from the storage
- ◆ inform local fire department about the type of pesticides stored and location of storage
- ◆ post a warning sign on all entrance doors to any pesticide storage facility
- ◆ keep emergency phone numbers posted in an accessible location
- ◆ keep pesticide storage areas locked
- ◆ do not store pesticide in glass containers in sunlight
- ◆ keep fire extinguishers approved for chemical fires near storage areas
- ◆ store combustible materials away from heating systems

If a fire occurs, call the fire department and keep people upwind and away from the fire. Warn firefighters of the presence of pesticides in the building.

Pesticide Spills

Be prepared to handle spills by having a pesticide spill cleanup kit when transporting, storing or using pesticides. Such a kit includes gloves, protective clothing, containers for contaminated waste, and absorbent materials such as clay, kitty litter or sawdust.

Report pesticide spills in accordance with all of the following:

- ◆ the *Sanitary Regulation of the Health Act* (Medical Health Officer located at a Regional Health Unit)
- ◆ the *Spill Reporting Regulation of the Environmental Management Act*
- ◆ the *Integrated Pest Management Act and Regulation*

If a pesticide spill occurs, proper cleaning and decontamination of the area may avoid environmental contamination. Implement the following practices:

- ◆ prevent exposure of people and animals to the pesticide and its fumes
- ◆ put on appropriate personal protective equipment
- ◆ prevent the spread of the pesticide
 - cover a liquid pesticide with soil, sawdust or any absorptive material to prevent spread or entry into a watercourse or subsurface drain
 - dry formulations can be swept up and reused if they have not become wet or contaminated with soil or debris
- ◆ place collected contaminated dry formulations and absorbent material into an empty clearly-labelled garbage container and contact MWLAP for information on appropriate disposal
- ◆ if possible, safely decontaminate the surface
 - check the label for specific directions – many pesticides can be detoxified by washing the area with chlorine bleach and detergent – do not use excessive amounts of water
 - prevent the wash solution from spreading and contaminating a larger area
 - if the spill occurs on the soil, remove the top 5 to 7 cm of soil (suggested), cover the area with lime and uncontaminated soil and contact MWLAP for instructions on disposal of contaminated material
 - if the spill occurs beside a watercourse, remove the top layer of contaminated soil immediately and relocate it to a safe site

Spills greater than 5 litres or 5 kg of product, mixture or waste must be reported. During cleanup of a spill, it is very easy to generate more than 5 kg of contaminated materials. By law, MWLAP must be contacted for advice on the proper method for disposal. If the spill takes place in a public area like a highway, call the local police. If the spill has released pesticide into the environment, contact the 24-hour Provincial Emergency Program (PEP) at 1-800-663-3456.

Pesticide Contingency Plan

Have a list of emergency numbers to facilitate notifying the local fire department of the amount and type of pesticide stored and the storage locations. Develop a contingency plan when storing any quantities of pesticides. The plan should provide a timely and effective response to any emergencies involving the release of pesticides into the environment, from:

- ◆ accidental spills, such as when transporting, storing, applying or dispensing
- ◆ release due to building fires or natural events, such as forest fires, floods, or earthquakes
- ◆ release due to vandalism
- ◆ application errors, such as applying the wrong pesticide or too much pesticide

